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STAFF REVIEW
OF
PROPOSED
WYOMING VALLEY PROJECT

WORKING DRAFT

JANUARY 9, 1974

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THE SUSQUEHANNA RIVER BASIN STAFF HAS CONDUCTED
A REVIEW OF THE PROPOSED WYOMING VALLEY FLOOD CONTROL
PROJECT IN WHICH THE PROJECT WAS EXAMINED FROM TWO
PERSPECTIVES - REGIONAL AND LOCAL. THE FOLLOWING IS
A SYNTHESIS OF THE MOST RECENT STAFF COMMENTS.

REGIONAL CONSIDERATIONS

A. Local Versus Regional Solution--The way in which the problem of flood damage reduction was addressed in the Wyoming Valley necessarily determined the nature of the proposed solution. That is, flood damage reduction was regarded on a local basis with no consideration of the need for flood damage reduction throughout the basin including the areas adjacent to the project area. Therefore, the proposed raising of the levees was considered in insolation of what was happening in the rest of the basin. Additionally, many of the assumptions were based on a replication of Agnes. This combined with the narrow, local considerations, raises several questions as to the overall reasonableness of the proposed project. It indicates a failure to examine the problem of flood damage reduction as a regional concern and a lack of consideration of other areas which may suffer increased damages because of this project.

B. Impact of Proposed Project--The Commission has the responsibility, along with the Corps, to develop a basinwide system of flood control structures integrated with non-structural flood damage reduction measures including flood plain management. The Commission must consider an approach which addresses both local and regional problems. The following hydrologic data is offered to indicate that the raising of the levees in the Wyoming Valley

will amplify downstream flood damages and increase the need for local flood protection in areas downstream of the Wyoming Valley.

1. Project Area - The design discharge for the existing levee in the Wyoming Valley is 232,000 cfs. The design top of levee (which includes 3.0 feet of freeboard) at the Wilkes-Barre gage is at a stage of 37.9 feet which corresponds to a discharge of 290,000 cfs. The design discharge for the proposed higher levee, is 320,000 cfs. The Agnes peak discharge was 345,000 cfs, considering the fact that the levees were breached. It was estimated that the peak discharge would have been 362,000 cfs, if the levees had not breached. Table 1 reflects the return periods of these discharges.

Table 1

<u>Discharge (cfs)</u>	<u>Condition</u>	<u>Return Period</u>
232,000	Regulated Existing Conditions	40
290,000	" " "	130
320,000	" " "	200
345,000	" " "	285
362,000	" " "	330
232,000	Regulated Existing Conditions and Tioga-Hammond and Cowanesque Dams	90
290,000	" " "	250
320,000	" " "	370
345,000	" " "	450
362,000	" " "	530

The observed peak stage was 40.9 feet at the Wilkes-Barre gage. The peak stage if the levees had not breached was estimated to be about 42.0 feet. Thus the Agnes peak would have been about 1.1 feet higher than observed in unprotected areas of the Wyoming Valley if the levees had been high enough to contain the Agnes peak.

2. Downstream at Project Area

a) Sunbury--The Corps of Engineers' study of the Agnes flood indicates that if the Wilkes-Barre levees had not breached, the discharge at Sunbury would have been 71,000 cfs higher. Because of uncertainty in the rating curve, the exact increment of stage is uncertain, but is estimated to be between 1.8 and 3.2 feet. Using the smaller value, the resulting water level elevation would be 452 at the south end of town and 456 at the north end of town. According to the Assistant City Engineer at Sunbury, the Agnes peak was within 0.5 feet of the top of the levee at the north end of town, and within 0.25 feet of the top of the wall between the Bainbridge Street bridge and the Reading Railroad bridge.

Thus, it seems reasonable to expect that the levee would have been topped and probably breached by the additional flow, and there would have been flow over the wall. It also seems reasonable to expect that Sunbury would have been inundated to approximately elevation 452 had the Wilkes-Barre levees held. Exhibit 1

delineates the area of the City of Sunbury that would be inundated by water at this elevation. Table 2 reflects the number of structures, by type, that would be subject to flood water damage.^a

Table 2

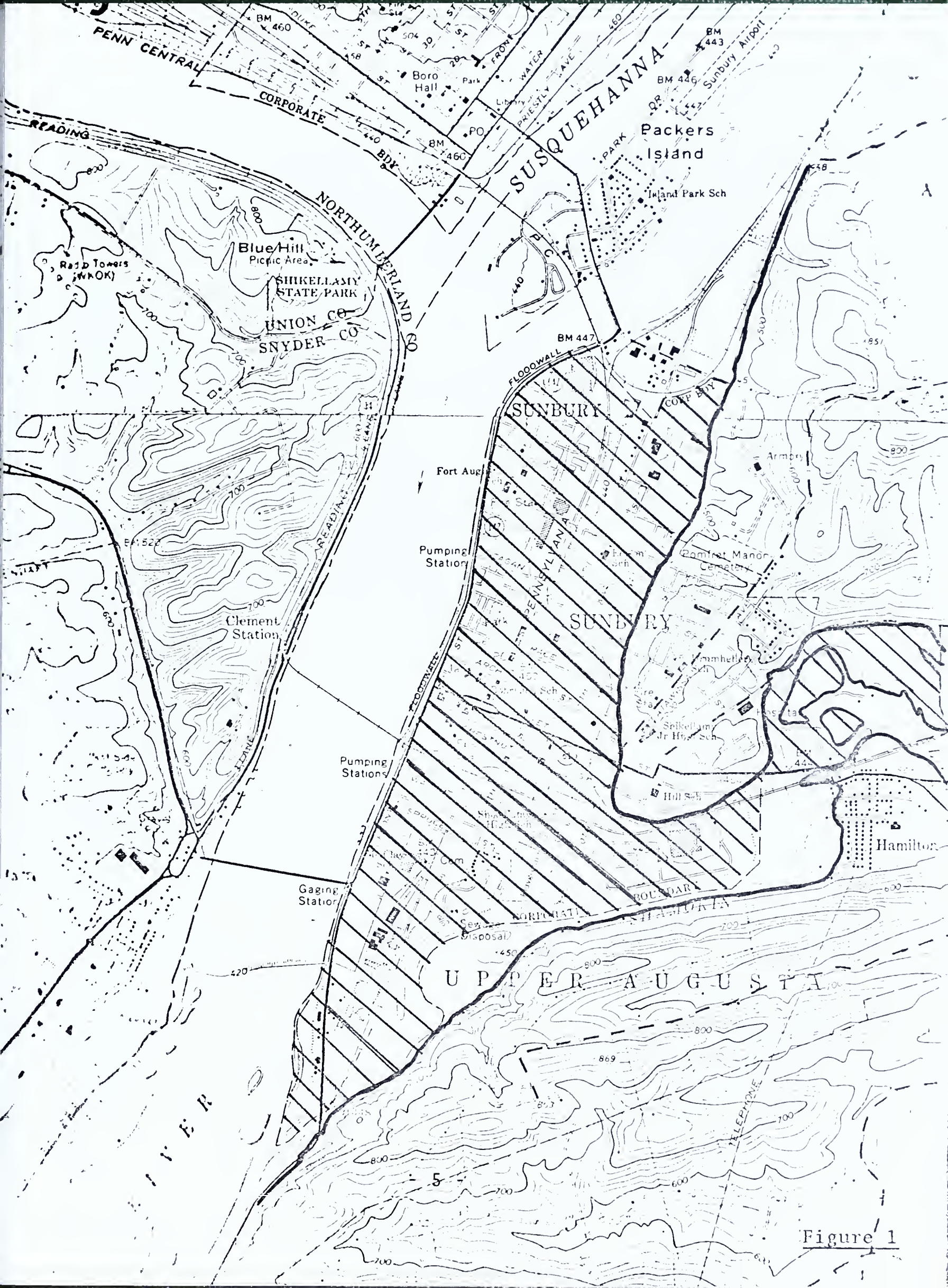
Ward	Assessed Value ^b (1/4 Actual)	Structures Subject to Flood Damage ^c			
		Single Family	Multiple Family	Commercial Industrial	Other
1	\$12,270,000	102	65	78	5
2	16,116,000	59	38	72	3
3	19,983,000	252	79	29	3
4	495,475	99	90	12	3
5	18,652,000	241	124	23	6
6	17,704,000	197	231	29	3
7	826,750	23	6	2	0
8	688,485	125	29	16	1
9	<u>10,980,400</u>	<u>95</u>	<u>238</u>	<u>34</u>	<u>0</u>
Totals	\$97,716,110 ^d	1,193	900	295	24

a - Data in this table was obtained by field survey. It is believed to be a conservative estimate of properties that are subject to flood water damage.

b - Assessed value does not include value of tax exempt property.

c - Ground level of these structures is at an elevation less than that of flood stage elevation.

d - At full valuation the total property value is \$390,114,000.



b) Danville--The effect of the Wyoming Valley levee break at Danville can be seen from the following table.

	<u>Discharge (cfs)</u>	<u>Stage (Feet)</u>
Observed	363,000	32.3
With Wyoming Valley Levee Not Breaching	<u>408,000</u>	<u>33.3</u>
Increase	45,000	1.0

The Commonwealth of Pennsylvania currently has a project under design which will raise the existing levees to 2 feet above the Agnes elevation. This will have the effect of further raising the Agnes elevation in the unprotected areas around Danville. Thus it is estimated that the Agnes water surface elevation in the unprotected areas around Danville would have been about 465.

C. Structural Alternatives to the Proposed Plan--There are several factors which suggest that more thorough study should be given to the possibility of upstream detention, as an alternative or supplement to the proposed levee raising, and which point out the advantage of a comprehensive approach to flood damage reduction.

a) Upstream Detention--At the time of the levee breach, in the Wyoming Valley, the total discharge at Wilkes-Barre was made up of the components reflected in Table 3.

Table 3

Total Discharge	290,000 cfs
From Above Vestal, New York	30,000 ^a
From the Chemung River	57,000 ^{a,b}
From Between Vestal, New York and Waverly, New York	<u>100,000^a</u>
Subtotal	187,000
Estimated Contribution From Area Between Athens, Pennsylvania and Wilkes-Barre, Pennsylvania	103,000 cfs

A general determination of the potential for flood under detention above Wilkes-Barre begins with a review of the amount of existing control. Table 4 summarized the existing control.

Table 4

<u>Sub-Basin</u>	<u>D.A. (Sq.Mi.)</u>	<u>Percent Existing Control</u>	
		<u>Sub-Basins</u>	<u>Total Above W-B</u>
Eastern ¹	4,944	7.2	3.5
Chemung	2,604	30.2 ²	7.8
North Branch ³	<u>2,412</u>	1.5	<u>.4</u>
Total Above Wilkes-Barre	9,960		11.7

a - Estimates by O. D. White, NOAA.

b - Not Peak on Chemung River.

1 - Susquehanna Headwaters to Athens.

2 - Includes Tioga-Hammond and Cowanesque.

3 - Includes Area Between Wilkes-Barre and Athens.

Only 3.9 percent of the total existing control is located in the 74 percent of the total basin drainage area above Wilkes-Barre. This implies that the Wyoming Valley is highly vulnerable to a storm centered over these areas, as are all other communities both upstream and to some degree downstream of the Wyoming Valley. It is believed that analysis of this matter would reveal potential to locate flood control structures within these sub-basins so as to distribute proportionately the control needed to provide protection to the flood hazard areas.

In light of the large volume of discharge that is estimated to have resulted from runoff between Athens, Pennsylvania, and Wilkes-Barre, Pennsylvania, it appears that sites on the major tributaries to the Susquehanna River in this area should be explored. Detention here would reduce substantially the peak stages experienced in the Wyoming Valley.

The following information adds creditability to the argument that upstream detention is a viable alternative to the proposed local flood control project.

The Agnes storm was most intense in the western part of the Susquehanna basin. O. D. White, Hydrologist in Charge, Federal-State River Forecast Center, has calculated that if the storm had been transposed 50 miles to the northeast, the peak at

Wilkes-Barre would have been 500,000 cfs or 45% higher than observed. The existing dams in the eastern basin would have provided little or no assistance to the study area. This is all the more reason to consider storage sites above Binghamton.

Another problem is the magnitude of the effect of the Tioga-Hammond and Cowanesque Dams. The Corps is assuming that these dams would reduce the peak at Wilkes-Barre by 25,000 cfs. But this is true only if the rainfall had the assumed spatial distribution of a standard project flood. If it has the distribution of the Agnes rainfall, the Corps routing calculations show that the peak at Wilkes-Barre would be reduced by 7,000 cfs. Therefore the discharge would be 1.8 feet higher than that designed for in the proposed project.

In summary it is felt that examination of sites for flood water detention in two areas - (1) between Athens and Wilkes-Barre, and (2) the Eastern Susquehanna Basin to provide protection for Binghamton, the Wyoming Valley and other downstream communities merits consideration as a feasible alternative that is regional, rather than local in nature.

LOCAL CONSIDERATIONS

Some aspects of the project, important from the local point of view were, we believe, inadequately addressed and should be more thoroughly discussed and described to assure that the project is well understood in terms of local implications.

A. Wyoming Valley Ground Water Conditions During Flood Stages Exceeding 3-Day Duration--Under existing conditions, with levees at original design height, areas behind the levee are subject to ground water flooding during a flood event. Much of the geologic formation underlying Edwardsville, Forty Fort, Kingston, Luzerne, Swoyersville and Wilkes-Barre contains thick deposits of very coarse grained glacial outwash, capable of transmitting water to wells at a rate of 2,000 gallons per minute (GPM). It is estimated the area behind the dikes would receive at least 8,000 and up to 30,000 gpm per linear mile of dike, from seepage through the aquifer from the river when the stage is near the top of the levee.

Part of Kingston is plagued with high ground water levels during periods of normal precipitation. Under prolonged periods of precipitation and above average river stages, basements in low areas are inundated by ground water. With the river at a stage near the top of the levee, many homes would have flooded basements

and the longer the river is at flood stage, the greater the number of normally dry basements that will become flooded. This is the result of inflow into the aquifer from the river, as well as recharge from precipitation normally accompanying flood events, and would occur with or without the proposed project.

It is believed that to minimize ground water flooding, to relieve water pressures under the dike, and to prevent piping and sand boils, it may be necessary to install a trench drain along the dike, where the drain can penetrate pervious stratum. Relief wells may be required in some areas where the pervious strata is deeper than can be reached with a trench drain.

The seepage water would have to be collected and pumped over the dike. This would require additional pumping stations with independent power plants. The additional pumping stations will impose further maintenance requirements on the local municipalities.

B. Superficial Analysis of Economic, Social and Environmental Effects--A significant impact that the project will have is that of changing or strengthening attitudes of the people of the Wyoming Valley toward flood damage reduction. The fact that the project apparently guarantees freedom from future flood damage will determine future social and economic plans. The increased sense of security offered by the higher levees may encourage area residents to look no farther for long-range solu-

tions to the problem. Further residential and commercial development will be encouraged in an already highly developed area. The nature and extent of such social and economic implications should be explored in more depth as there is a clear relationship between the proposed project and land-use patterns.

The probable environmental effect, which is inextricably tied with the social and economic effects, is the irreversible commitment of the undeveloped, open land behind the levees. Open land is a scarce resource within the urbanized areas of the Wyoming Valley. Such land has a significant benefit as open space and this benefit will be lost if the proposed project is completed and land use controls to prevent high density development are not imposed.

C. Project Completion Time and Potential Cost Escalation--To our knowledge these topics have not been directly discussed, however, the Survey Report and the tone of the Corps' comments at the public hearing December 5, 1972 and at a meeting on February 17, 1973 seems to imply that the project, if authorized, can be completed in a short time period. This time factor understandably appears to play an important role in local acceptance of the proposed project.

Experience indicates that early completion of the project,

even with prompt authorization, may well mean a minimum of ten or more years. This observation is based on recognition of the many outstanding, complex matters to be resolved.

Actually the Corps' Survey Report does little more than identify a very preliminary scheme for providing local flood protection. Detailed hydrology and hydraulic studies must be conducted. The many complexities of raising and/or rebuilding one or more major bridges must be carefully studied. Bridge raising, if undertaken, would have to be carried out in a manner to assure adequate cross valley transportation could be maintained. The problems of tying approach ramps to higher level bridges appear quite extensive and may well have an extremely significant effect on existing downtown developments. The need to coordinate this effort with other agencies and their existing programs and plans (Penn DOT, Railroads, and City Government) and gain their approval will take time, as will resolution of several other complex engineering aspects of the proposed project.

The preliminary cost estimates, which seem quite conservative, can be expected to escalate considerably with more detailed identification of the many problems involved. A major part of cost escalation could be a local responsibility.

We agree that a definite time frame for completion of the proposed project cannot be accurately projected now. However, as certain alternatives were ruled out in the Survey Report because of the length of time required to consider and implement them, there is need to provide some preliminary estimates for comparison of the time needed to conduct the necessary investigations and studies required to plan the proposed project, develop final design and complete all phases of construction.

ECONOMIC CONSIDERATIONS

The economic feasibility analysis should be reevaluated considering the following:

A. Water Resources Council's Guidelines--The Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources" should be followed with particular attention to the interest rate recommended and the accounting objectives addressed.

B. Inclusion of Regional Impact in Benefit-Cost Analysis--The analysis of the proposed project included only consideration of the impact on the project area. Therefore the analysis should be expanded to include not only benefits and costs to the project area but to all areas impacted by the project. Preliminary staff analysis which expanded the area of consideration to include not only the four areas protected by the proposed project, but to also include the area between the Wyoming Valley and Sunbury which would be impacted by the project suggests that the project as proposed is not economically feasible. This is based on the fact that when the damages incurred by the project outside of the Wyoming Valley are incorporated into the analysis, the calculated average annual damages prevented by the project are reduced to approximately one-half their estimated value when only those prevented in the project area were analyzed.

C. Post Flood Investments--Extensive allocations of monies in the project area, through both governmental and private flood recovery efforts, have been made since the initial project analysis was proposed. These investments may have significant impact on the estimated average annual damages prevented by the proposed project and should be included in the analysis.

CONFORMITY AND CONFLICT WITH THE SUSQUEHANNA
RIVER BASIN COMMISSION COMPREHENSIVE PLAN

A. Areas of Conformity--The project conforms with two of the guidelines and criteria stated in the Comprehensive Plan. They are:

(#9) Structural measures should not be considered for urban or other developed areas unless their design provides for a desired minimum protection against the flow of the 100-year flood, or, if necessary, a flood of greater magnitude modified or anticipated watershed conditions.

(#23) Any project proposal submitted to the Commission for review and possible inclusion in the Comprehensive Plan shall fulfill National Environmental Policy Act requirements.

B. Areas of Conflict--The project does not appear to meet the objective of the Flood Plain Management and Protection Program which calls for "an integrated system of structural flood control and non-structural flood plain management measures". It is also at this time questionable as to whether this project

would fit into "a basinwide plan to reduce future flood damages" as recommended in the Early Action Program and in the goals of Flood Plain Management and Protection.

The project clearly conflicts with two guidelines and criteria.

(#3) The need for a project must be clearly substantiated by supporting data, alternatives defined and the basis for the choice described, and willingness indicated by all interested parties to meet funding requirements.

(#22) Any project proposal shall consider the potential impact on upstream and downstream areas.

C. Areas of Uncertainty or Question--The primary objective of flood plain management and protection is "to prevent loss of life and significantly reduce future damages from floods". This will undoubtedly be accomplished in the Wyoming Valley area. Yet, the Commission must be concerned with the entire basin; the level of damages to be suffered with the project in upstream and downstream areas will determine whether or not the project in fact meets this goal. If the benefits (reduced damages) exceed total costs, the proposed Wyoming Valley Project would then fulfill

guideline (#1) - "projects shall provide for beneficial water resources management and development".

Though the project appears to fulfill the legal requirements of the National Environmental Policy Act, it is considered that the Environmental Impact Statement inadequately addresses "(iii) alternatives to the proposed action" and "(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity".

Two planning objectives stated in the Commission's Comprehensive Plan which are of interest in evaluating the project are:

(a) To give careful consideration to the multiple planning objectives of national economic development, environmental quality, social well-being and regional development with reasoned choices being made among them when they conflict.

(b) To integrate the various facets of water resources planning and development programs with land use planning.

It would appear that the multiple planning objectives would be fulfilled in the Wyoming Valley at the expense of those objectives in upstream and downstream areas.



